Project Proposal:
Biological Reference Curves for James River Chlorophyll a Criteria, Phase I & II

Interstate Commission on the Potomac River Basin
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REVISED
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Project Scope and Goals

The Chesapeake Environmental Communications (CEC) and Virginia Department of Environmental Quality (VADEQ) would like the Interstate Commission on the Potomac River Basin (ICPRB) to investigate and if practical, develop chlorophyll (Chla) biological reference curves specific to the James River. ICPRB staff Claire Buchanan will perform the analysis. The project will be accomplished in two Phases:

Phase I – data analysis

- Identify sampling events in existing data sets that have "reference" water quality conditions, i.e., nitrogen and phosphorus concentrations low enough to limit the formation of algal blooms and water clear enough to support healthy plant life.
- Use chlorophyll a concentrations in these reference samples to develop biological reference curves for a range of assessment windows (potentially 3-year, 4-year, and 5-year) and a range of potential chlorophyll a assessment criteria, including the current James River chlorophyll a criteria.
- Produce Excel spreadsheets with metadata

Phase II – report

- Produce a final report of up to 10 pages to be submitted to VADEQ and the James River Science Advisory Panel for review. A key question to address: do the biological reference curves approximate the "10% rule" curve currently used by CBP in criteria assessments?

ICPRB is applying to CEC for funds to accomplish Phase I and to VADEQ for funds to accomplish Phase II.

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Project Implementation

Phase I
Cost: $5,663
Due: June 15, 2014
Deliverable: Excel spreadsheets with metadata
Description of work:

1. Receive water quality databases from CEC

   The data ideally will include the available records collected at Chesapeake Bay Program tidal monitoring stations in the Bay and its major tributaries between 1984 and present. Each sampling record should have the associated salinity, DIN, PO_4, Secchi, and chlorophyll a data. (However, if either DIN or PO_4 is missing but Secchi is present, the sampling record is still useable and should be included.) For chlorophyll a, both the Surface values and average Above-

Pycnocline (AP) values (or water column values when a pycnocline isn't present) are needed. If possible, pycnocline depth (if present) and average values of TN, TP, DOC, TOC, TSS, DO and pheophytin for the AP layer should be included. Station information should contain station name and CBP segment.

2. Identify reference quality sampling events

   Follow the data preparation and evaluation methods described in Buchanan *et al.,* 2005, Estuaries 28(1):138-159. Extract the reference events and their associated chlorophyll data. Group data by the relevant salinity zones and seasons.

3. Investigate and develop biological reference curves

   Develop biological reference curves from cumulative frequency distributions (CFD) using the Weibull formula. Curves will be developed for individual season-salinity groups (e.g., spring tidal fresh, summer polyhaline). "Space" violations will be calculated by dividing the overall number of criteria exceedances in a season-salinity group by the total number of sampling events. To generate CFDs for each season-salinity group, space violations will be plotted against the ranked percents of "time" violations. Investigate a range of assessment windows (potentially 3-year, 4-year, and 5-year) and a range of potential chlorophyll a assessment criteria, including the current James River criteria. Determine how closely the reference curves approximate the CBP "10% rule" curve. Consult with VADEQ as to how the biological reference curves can be refined to meet VADEQ assessment needs. Note: construction of the biological reference curves will not exactly mirror the current Virginia CFD-based assessment methodology because the curves will be based on un-interpolated, fixed station data from selected (reference) sampling events.

4. Produce Excel spreadsheets with metadata

   Spreadsheet will contain a) the Reference sample data used to develop the biological reference curves, b) Excel graphs of the curves, and c) metadata describing data sources and analysis steps.

Phase II

Cost: $6,472
Due: June 15, 2014
Deliverable: report
Description of work:

1. Produce a final report

   Report will be up to 10 pages in length. A draft will be submitted to VADEQ in April 2014 and subsequently to the James River Science Advisory Panel (SAP) in May 2014. ICPRB will incorporate comments received by May 31, 2014 from VADEQ and the James River SAP, and submit a final report to VADEQ by June 15, 2014. The report may include suggested biological reference conditions that are both spatially and temporally based on Virginia's current chlorophyll standards. Depending on such results and suggestions from VADEQ, the report may also include recommendations for proposed changes to the current criteria as well as assessment procedures.

2. Evaluate calibration data collected with the DATAFLOW data

   These data will be provided by CEC and reviewed to ascertain their potential future use in developing biological reference curves. Recommendations will be included in final report.